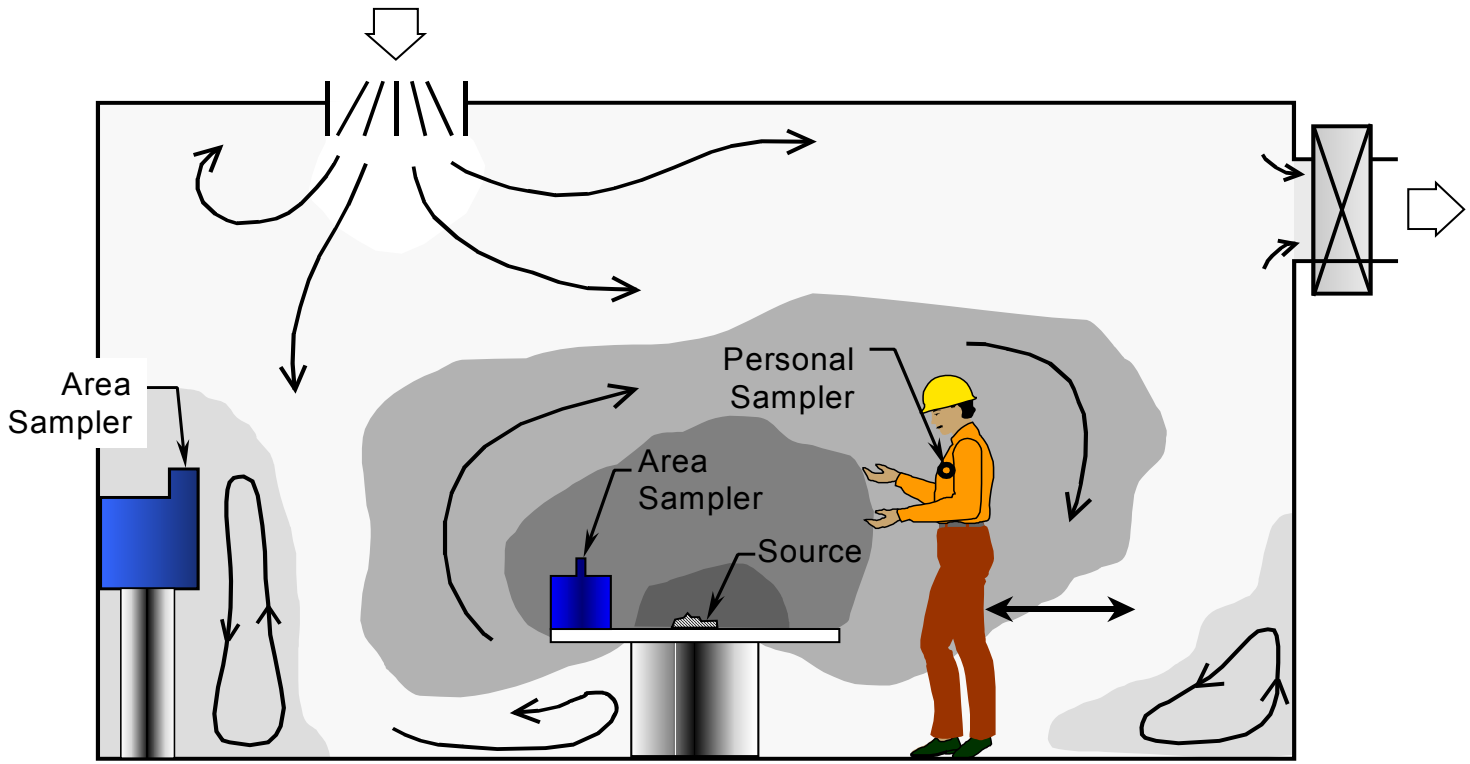
Strategies and Methods for Optimisation of Protection against Internal Exposure of workers from industrial natural sources (SMOPIE) .

C Lefaure. P Shaw. J Van der Steen.



SMOPIE Objective 5th PCRD

ICRP remind us that ALARA has to be implemented for both external and internal exposures

In the NORM doses mainly from internal may reach a significant percentage of limits = predictable dose (not accidental)

To arrive at recommended monitoring strategies and methods for optimising protection against internal exposure in a wide range of predictable occupational exposure situations

SMOPIE introduction

- **Work activities with NORM can involve significant exposure of workers, due to internal contamination by inhalation**
- **However, there can be considerable differences in work place conditions, radionuclides involved and the physical and chemical matrices in which the radionuclides are incorporated**
- **The study covers a variety of practical exposure situations in industries with NORM**

SMOPIE introduction 2

For optimisation of the protection of workers, it is necessary to answer the following questions

What doses have been received by whom?

Where has it been received (work places)?

When has it been received (jobs, tasks)?

SMOPIE Introduction3

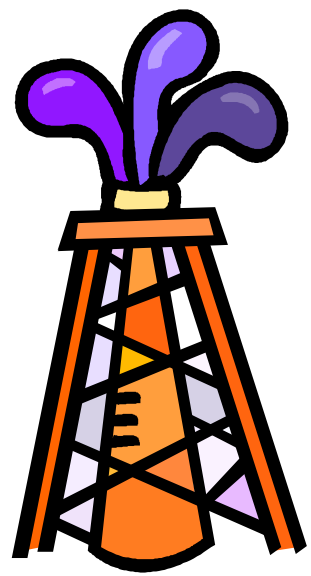
- This determines the monitoring methodology for optimisation
  - Bioassays do not allow to answer all the previous questions
  - Only way is by monitoring through air sampling
    - Personal air sampling
    - Static air sampling
    - Real time dust monitoring
- The dose assessment requires:
  - Knowledge of dose coefficients
  - Knowledge of lung clearance classes
  - Knowledge of particle size distributions
  - Knowledge of radionuclide characteristics

SMOPIE *Estimates of number of exposed workers*

Type of industry and work activity	Order of magnitude estimated number of workers with dose > 1 mSv/y	Basis for estimate
Thoriated electrodes, grinding and use and production	70,000	Extrapolation of Dutch and German data
Phosphate fertiliser trade and use	10,000	German data multiplied by 4
Oil and gas production, exposure to scale dust at maintenance	2,000	Based on 1000 production installations and 2 workers potentially exposed annually per installation

SMOPIE *Estimates of number of exposed workers*

Total **85,000**



SMOPIE *Estimates of number of exposed workers*

There is a lack of published data on the actual numbers of exposed workers and the doses received

Much more data based on industry surveys and workplace measurements is required to provide an accurate position of the situation in EU NORM Industries

Already NORM network questionnaire provides new information; ie coal industry…(frequency of answers)

SMOPIE conclusions

- **The assessment of internal exposure of workers to industrial natural sources should be based on PAS, which is the preferable tool**
  - **to identify specific workstations and tasks**
  - **to assess the effectiveness of countermeasures against such sources**

SMOPIE conclusions

- **SAS and RTDM can be useful**
  - **to identify specific sources of airborne dust**
  - **to identify specific workstations and tasks**
  - **to assess the effectiveness of countermeasures against such sources**
- **SAS cannot replace PAS for dose assessment purposes**

SMOPIE conclusions

- **Usually there is no (detailed) information available on the particle size distribution of aerosols**
- **The dose coefficients for Type Slow and Moderate natural radionuclides are AMAD-dependent**
- **The preferred sampling convention for PAS is thoracic for Type S and M aerosols and inhalable for Type F**

SMOPIE conclusions

- **The exposure assessment should take care of the following**
  - **Correction of the sampled activity to true ambient aerosol concentration with 5µm default AMAD (GSD 2.5) depending on the sampling convention**
  - **Correction of the possible underestimation in the assessed dose if the preferred sampling convention, in relation to lung absorption type, is not available**
  - **Application of a dose coefficient based on the actual or most likely lung absorption type of the aerosol**

SMOPIE conclusions

- **A large bias (positive or negative) can result when the dose coefficient is based on an assumed lung absorption type that is different from the true lung absorption type of the aerosol**

- **Further guidance for users is needed on the statistical nature and analysis of monitoring results**

EAN 9Th Workshop recommendation 7

- **The SMOPIE report recommendations were endorsed by the Workshop, and follow-up actions are recommended. In particular:**

  - **ICRP is requested to review the applicability of existing dose coefficients to natural radionuclides in NORM. Depending on the outcome of this review, the Commission is requested to consider a possible revision, or expansion, of their recommendations. In particular, the issues to be addressed include the lung solubility classification of radionuclides, the intake of radionuclides contained within inactive carrier particles, and the rate of radon emanation from such particles;**

EAN 9Th Workshop recommendation 7

- The SMOPIE report recommendations were endorsed by the Workshop, and follow-up actions are recommended. In particular (followed):
  - **… and**
  - **air sampler manufacturers and users should note the recommendations for the development of new devices, in particular the need for reliable thoracic samplers for radiation protection use.**

EAN 9Th Workshop recommendation 8: Further guidance for NORM users

- **Practical guidance for NORM users has started to appear: the Safety Reports issued by IAEA, and the SMOPIE report, are especially acknowledged. Further work is, however, still recommended, and the NORM network being proposed by the EC might address this. In particular:**
  - **further exploration of the use of activity concentration values (Bq/g) as a practical means of indicating the need for certain actions or controls is recommended. These levels should be related to specific industrial processes, and be derived from workplace measurements and operating experience;**

EAN 9Th Workshop recommendation 8: Further guidance for NORM users

- Practical guidance for NORM users has started to appear: the Safety Reports issued by IAEA, and the SMOPIE report, are especially acknowledged. Further work is, however, still recommended, and the NORM network being proposed by the EC might address this. In particular:

  - **a graded approach to exposure assessment, as recommended in the SMOPIE report, is supported, but needs to be tested in practice and, if necessary developed further;**
  - **more guidance on radiation protection monitoring and control in specific NORM industries is still required; and**
  - **training and awareness material for workers should be developed.**